SCIENCE.

FRIDAY, FEBRUARY 5, 1886.

COMMENT AND CRITICISM.

THE INTERNATIONAL COPYRIGHT LAW has received new interest by the introduction of Senator Hawley's recent bill. It is remarkable with what unanimity the better class of authors, periodicals, and publishers have long sought unavailingly the passage of such a bill. In the recent hearing before the senate committee, a number of our most prominent authors spoke in favor of the passage of some law on international copyright. Prominent among those who favored the measures were the Rev. Dr. Crosby, Mr. Henry Holt, Mr. George Ticknor Curtis, Mr. H. E. Scudder, Mr. James Russell Lowell, Mr. Estes, Mr. Samuel Clemens, and others. A memorial signed by over two hundred prominent authors was also presented. The arguments used by these gentlemen were, that the present system of copyright law was not only disadvantageous, but dishonest and unjust; that it worked to the great disadvantage of American authors, and prevented the publication of many meritorious works; that it made books dearer, and lowered our literary taste. Mr. Lowell was satisfied that the reading public of America being much larger, and the demand for cheap books greater, the result of a copyright law would be the transfer of the great bulk of the book-trade to America. Of course, in the passage of such a law, measures should be instituted to protect those who have been encouraged under our laws to become pirates of foreign books. Some, among whom Mr. Clemens may be mentioned, urged that the bill should require all foreign books to be printed here.

THIS COUNTRY IS NOT ALONE in its trouble with the silver question. At the meeting of the council at Calcutta on Jan. 11, the most diverse views were expressed as to the influence the depreciation of silver has had in benefiting the trade of monometallic (silver) India. On this subject public opinion is said to be hopelessly divided. Speaking generally, the commercial men are inclined to agree with Mr. Steel's view, which he upheld at the council meeting, that India is a distinct gainer by the depreciation; while the rest of the community, following the lead of Sir A. Colvin, Mr. Hope, and Mr. Evans, attribute the extension of trade to other causes, and regard the continued depreciation of silver as a most serious danger, calling for careful consideration and prompt action on the part of the home government.

THE GREAT DECREASE in the numbers of many of our birds during late years, brought about in the interests of fashion or other mercenary motives, or through malicious wantonness, has induced the Ornithological union to appoint a committee, composed of a number of our leading ornithologists, on the 'protection of North American birds,' whose object shall be the gathering of information on the subjects of their destruction and protection. The committee will welcome information from any source, and those interested are urged to address such to the officers or members. The secretary is Mr. E. P. Bicknell of New York.

THE INVESTIGATIONS in economic ornithology began under the department of agriculture, July 1, 1885, and have already been successful in bringing together a very large amount of useful material. The scope of the inquiry is, briefly, the collection of all information leading to a thorough knowledge of the inter-relation of birds and agriculture, and concerns both the food-habits and the migration and geographical distribution of North American birds. About fourteen hundred observers are scattered all over the country. Prof. W. W. Cook, superintendent of the Mississippi valley district has prepared a report which is the most valuable contribution ever made to the subject of bird-migration. It is now in the hands of the printer. The English sparrow exerts a more marked effect upon the interests of the country than any other species of bird. The unprecedented increase and spread of this naturalized exotic, taken in connection with the extent of its ravages in certain districts, is regarded with grave apprehension. The study of this little pest developed the fact, that while it does sometimes eat grasshoppers, cicadae, and other insects, the sum of its injurious qualities probably exceeds and outweighs the sum of its

benefits. The Ornithological union has hopes that congress, during the coming session, will provide means for the proper extension of the inquiry. The practical bearings of the investigations are not obscure. When the limitations of the several faunal areas have been ascertained with sufficient exactness, it will be possible to predict the course which an injurious insect will pursue in extending its march from the point where its first devastations are committed; and farmers may be thus forewarned, so that those living in districts likely to be infested can plant different crops, and thus be saved large pecuniary loss, while those living just outside will derive increased revenue from the particular crop affected.

THOSE WHO DO NOT as yet feel sure of M. de Lesseps' ability to carry through his canal from ocean to ocean will be surprised to learn that he is already planning to take part in the long-discussed project of an African inland sea. On the 20th of January a meeting was held in Paris by the promoters of the North African inland sea scheme, at which M. de Lesseps stated that Captain Landas was about to survey the Tunisian oases, and that on his own return from Panama, by April at latest, the company would be formally constituted.

RECENT NUMBERS OF THE *Rundschau* illustrate some aspects of psychological activity to which the German public are giving attention. Professor Golz contributes a lengthy but very well written article on brain localization. Professor Golz is generally regarded as an extreme 'anti-localizationist.' Perhaps the present article embodies his later convictions, in which, though not yielding his former position, he has stated it in a way that allies his opinions with those of other experimenters. He calls his article 'Modern phrenology,' comparing the modern attempt to mark off the cortex of the brain into functional areas to the attempts of Gall and Spurzheim to correlate mental faculties with cranial formations. The cortex is not, according to his views, a mosaic of sensory and motor areas, such as Ferrier, and especially Munk, would have us believe. The experiments do not bear out that conclusion: for the loss of motion and sensation following the extirpation of certain brain areas is not permanent; the function is regained if the animal survives. In many cases the animals have not been kept long enough. The lack of certainty that the underlying fibres have not been stimulated is another objection. Moreover, there is no part of the cortex of which you can say that its removal must cause the loss of sensation or of motion. Not even Broca's convolution, the close relation of which to the language centre has always been a firm support to the localizers, is exempt from this criticism. Professor Golz devotes the main part of his paper to a critical review; in conclusion, however, he suggests what he considers to be the true relation of cortex to function. Flourens thought that the whole cortex was alike in significance: modern 'localizers' hold that no two parts are functionally alike.

The true view lies between the two. If we compare the cortex to a map, Flourens would make no distinction between one part of the map and another. The 'localizers' mark it off into countries; i.e., political divisions, with sharp, distinct boundaries. Professor Golz would mark his map off like those which represent the distribution of plants. In one part the vine would have its centre; in another, rice; in a third, barley: but each would have some vine, some rice, and some barley, although there would be places which would have neither. The boundaries between the regions are loose: we have a focus, but it is not a point. These views are certainly rational, and coincide almost exactly with Lunani's and Exner's results. Perhaps it is not too hazardous to say that a strict localization of function can no longer be upheld.

In the last number, Professor Preyer warns the German public against accepting the results of the English society for psychic research as regards telepathic communication. He explains away the facts upon which their conclusions are based by showing a neglect of the sources of error. In guessing what was being written in another room, the errors made were of such a nature as would occur if the hand had been seen (not errors in the hearing of the words): hence, as the girl who did the guessing was alone in the next room, Professor Preyer ascribes the telepathy to the keyhole. He certainly has made out a strong case, and, what is more important, has shown that the English society has not made its case nearly strong enough to found upon it so alarming an hypothesis as the communication of mind with mind without the use of the ordinary channels of sensation.

AT A MEETING of the Cosmos club of Washington on Monday, Feb. 1, it was decided to purchase the 'Wilkes' property, on the corner of Madison Place and H Street, a few doors north of the present quarters of the club. The club proposes to build an assembly-room, to be used for receptions and for meetings of scientific societies. The resolution to purchase the property was passed unanimously, and is a move in the right direction. The present quarters are very limited, and, as the club is growing so rapidly, pressing need was felt for more room. The newly acquired property is situated in one of the most desirable localities in the city, and will afford the club many conveniences and comforts hitherto denied them.

AMERICAN FISHERY INTERESTS.

THE fisheries-treaty question, which is now the subject of so much discussion, is a very complicated one; and it is not at all surprising that the secretary of state, following traditionary policy of more than a hundred years' standing, and acting upon the long-established theory that participation in the fishery privileges of Canadian waters is of great value, should have failed to satisfy the expectations of the New England fishermen, who know so well that these privileges have long been valueless. A general impression seems to exist that our fishing-fleet no longer visits the Gulf of St. Lawrence, only because there has been a temporary desertion of those waters by the species of fish which they seek. Such, also, is the idea of the Canadians. In his recent article in the *North American review*, Lord Lorne patronizingly suggests to his 'good friends' across the line that they should not be too hasty in throwing aside the right to fish in English waters, because the fish may before long return in their former abundance.

As a matter of fact, the abundance of fish in the Gulf has very little to do with the question as it now presents itself. Since 1871, when the Washington treaty was negotiated, a complete revolution has taken place, both in the fisheries and the fish trade of the United States; and, strangely enough, this revolution was effected chiefly in the six years which intervened between the completion of this treaty and the meeting in 1877 of the Halifax convention, by which $5,500,000 were awarded to Great Britain as a compensation for a concession to our fishermen, which had ceased to be of value to them, in addition to the remission of duties on Canadian fish, which during the period of fourteen years have amounted to several millions of dollars. Our government has thus, unintentionally of course, been paying each year a large subsidy to the fisheries of British North America, and developing the Canadian fisheries at the expense of our own; and Canadian competition has become so great that our fishermen feel that they have a strong claim upon the government for some kind of protection. The fishermen therefore demand that the duty upon Canadian fish be restored, and that their own privileges shall be based upon the provisions of the treaty of 1818, which will again go into effect, if no new treaty arrangements are made. Our dealers in cured fish, on the other hand, mindful of the profits of handling the product of the Canadian fisheries, are clamorous for a continuance of the present free-trade policy.

The revolution in the American fisheries is so extensive that it can scarcely be discussed in a notice so brief as this. One of the principal changes is the adoption of the purse-seine in the mackerel fishery, by which the fish are caught far out at sea and in immense quantities by enclosing them in an immense bag of netting. Formerly they were taken solely with hooks by the 'chumming' process. This was in the best days of the Gulf of St. Lawrence mackerel fishery, when hundreds of American vessels would frequently lie side by side, throwing overboard vast quantities of oily, mushy bait, by which the schools of fish were enticed within reach. There is no reason to doubt that mackerel were as abundant then as now off our own coast, but the old method of fishing was not so well adapted to our waters. The purse-seine, on the other hand, cannot be used advantageously in the Gulf, nor is there any necessity for our fishermen to go so far from home for their fish. There does not appear to be any probability that our fishermen will ever return to the old methods. 'Chumming mackerel' is essentially a lost art.

Another feature in the revolution is the introduction of improved methods of marketing fresh fish. With the extensive refrigerating establishments now in operation, and the facilities for rapid transmission of sea-fish inland, the demand for salted fish is relatively very much less than it was fifteen years ago. Then, too, the immense competition produced by the free entry of Canadian fish has lowered the price of cured fish, until a very decided depreciation in its

quality has resulted, with a consequent decrease in demand.

The present condition of the sea-fisheries of New England is a deplorable one. Whatever is to be done for their amendment, it is to be hoped that our diplomatists will not suppose that they will profit by the privileges of free fishing in Canadian waters.

ELEMENTARY SCIENCE-TEACHING.

FROM all sides comes the advice to study science. Teach science to children, put it in the kindergarten, double the amount of it at college, and foster it at the universities. The opinion seems to be current, that, by introducing a branch of science on the school curriculum, the magic effect is to be won. To give children objects to handle, to see, to describe, and to puzzle over, is certainly an excellent discipline.

But the far-famed benefits to be derived from science do not centre there, nor is it with the methods of teaching science that fault is to be found. The methods have been carefully worked out: models, diagrams, specimens, excursions,— all are pressed into service; and, though the results of this world-wide scientific movement have been great beyond all expectation, one will readily accept the statement that elementary science-teaching — excepting to elementary learners, children just beginning their school education — is not always gratifying work. To school-children who have already received their formative training, — who have swallowed, perhaps digested to a greater or less extent, the usual doses of book-learning, — whose minds have been set in the rut of an arbitrary bookish study method, the introduction of a science course often brings more pain than pleasure.

A case in point recently came under my notice. At a school for girls, an able and interesting lecturer gave a course in physiology. The lectures were illustrated, and well-directed efforts were made to make things clear. Recently an examination was held, and perhaps it will be worth while sampling some of the more characteristic answers to the questions then asked. The stomach is put 'in the chest,' or 'is covered by a muscular bag called the pericardium,' or 'is mostly on the left side, just south of the heart.' The authority for the last statement also showed an indignant surprise at being told that her heart was nothing but a muscle. Another anatomical fact not yet recognized by the text-books is that 'the scapula has no shape.' 'Capillaries are small particles in the blood,' or 'are depressions in the arteries, and they change the fatty parts into blood.' Some feats of swallowing and digesting are described. 'The food passes from the mouth through the blood to the stomach,' or 'is attracted downwards, and then your Adam's apple slips over it:' 'it passes first to the small, then to the large, intestine.' The surgery is also peculiar. When an artery is partly cut, you are advised 'to cut it open so as to prevent the loss of too much blood,' or 'to cut it entirely so as to allow it to coagulate.' The terms, too, are caught up inexactly and without definite ideas: 'vains,' 'venus,' 'gaul,' 'color-bone,' 'clerical' (for 'cervical'), 'ablutions' (for 'albumen'), 'humerous' (for 'humerus'). By a peculiar association of ideas, the young lady responsible for the last innovation states that this bone is commonly called the 'crazy' bone.

On the whole, the answers were very good. Those given above are purposely selected for their peculiarity. The girls too, with some exceptions (mostly from twelve to sixteen years of age), took great interest in the subject. Nor is the school to blame. The early training of these girls was entirely opposed to these new methods of teaching. It is not the science that is strange to them; but there is a struggle going on in their minds parallel to the battle between the 'new' and the 'old' educationalists in the reviews. This leads to a confusion of thought, a muddled-headedness, which perhaps is the most characteristic feature of the above answers. The whole moral can be summed up in one phrase. It is not in the direction of science-teaching, but of scientific teaching (and that, too, from the cradle onward), that the future of education is to develop.

With the above experience fresh in mind, I came upon a second example of elementary science-teaching, of a most ingenious kind. It is nothing less than an attempt to give to children an account of the physiology of the brain (Frank Bellew, *St. Nicholas*, February, 1886). The 'firm of Big Brain, Little Brain & Co.' tends to the business affairs of the body. The cerebrum is the administrative department. There the head of the firm, old Big Brain, sits at his desk surrounded by papers and all the appliances of a modern business-office. At one side is a telegraph-key to bones; on the other, pigeon-holes and register cases. Below him, on one side, is Little Brain, (the cerebellum), a little elf tending to the machine; on the other, the ganglia, or gang of five clerks on high stools. These put down the accumulated expenses of Big Brain, and do the book-keeping. One of the little band is in the office receiving an order from Big Brain. In the middle is the Bridge (Pons), keeping up a continual clatter of telegraph-keys, transmitting messages from one part of the brain to

another, in all directions; and still farther down is Medulla. He has charge of the life department, and keeps working the bellows, and running the fire of life. And through this allegory you are to 'know more about the contents of your knowledge-box than you did before.' Only a reading of the article itself, and an enjoyment of the grotesque illustration, will convey an idea of its extreme clearness; and, after such a reading, no excuse will be necessary for calling attention to this effort as an illustration of modern elementary science-teaching. JOSEPH JASTROW.

TOTAL-ABSTINENCE TEACHING IN THE SCHOOLS.

IN 1884 the legislature of the state of New York, in response to forty thousand petitions, passed an act by which all schools supported by public money or under state control are required to instruct their pupils in physiology and hygiene, "with special reference to the effects of alcoholic drinks, stimulants, and narcotics, upon the human system," and prohibiting the granting of a certificate to any person to teach in the public schools except after passing a satisfactory examination in physiology and hygiene with special reference to the effects of alcoholic drinks, etc. A similar law has been passed in at least fourteen states of the union. This action, it is claimed, is due to the Woman's Christian temperance union.

It was at one time questioned whether such a law was constitutional, and how far it could be enforced. The state superintendent, W. B. Ruggles, in a letter to Commissioner Perrigo, at Potsdam, says that it is the duty of the local school authorities to provide for such instruction; the duty of the teachers to give the instruction; and the duty of parents to cause their children to conform to the course of study in these subjects, as in any other studies prescribed under the law. He goes still further, in declaring that a persistent refusal of a pupil to receive instruction in physiology or hygiene may justify the school authorities in excluding such pupil from the benefits of the public schools. A similar question has arisen in reference to the vaccination law in the state of New York, passed in 1860. In that law the legislature distinctly authorizes and directs the exclusion from the public schools of children not protected from small-pox; and, so far as we know, this power and duty have never been abridged or questioned by the courts. It would seem, therefore, that the conditions under which children may participate in the benefits to be derived from being educated at the public expense are lawfully within the power of the legislature to prescribe, provided always that constitutional provisions are not violated.

The immediate result of the passage of these compulsory laws has been to cause a remodelling of the text-books of physiology and hygiene in order to meet the requirements of the legislatures. Some of these have been but little changed, except to be enlarged by a few chapters on alcohol and tobacco; while others have been entirely rewritten with the special object of making them conform to the new demands. It is the opinion of at least one lawyer, reputed to stand high in his profession, that the main object of these statutes is to provide for scientific temperance instruction in the schools; that the use of works on physiology and hygiene is a mere method of accomplishing this result; and that any instruction which, while making physiology and hygiene its leading feature, only incidentally bears upon alcohol and narcotics, is not a compliance with the law, and therefore school authorities are only justified in using as text-books those which make the effects of alcoholic drinks, stimulants, and narcotics upon the human system their special object. If this opinion is correct, very many of the books which have been recommended for introduction into the schools since these compulsory laws were passed would be discarded, as they are primarily works on physiology and hygiene, and secondarily teach temperance. The number of books which have thus far appeared to meet the new demand exceeds twenty.

One of the most prominent temperance writers thus explains the failure of temperance movements hitherto, and points out what he thinks to be the hope of the future.

"The temperance efforts of the past failed because all temperance decrees proceeded from the sovereign, and were as changeable as his whims and caprices, and also because it was not known that alcohol was always a poison. The modern temperance movement is based on knowledge and on a sentiment of fellowship and fraternity. The great advance made in physiological science has been applied to the study of the effects of alcohol upon the human system, and from this the most beneficial results may be expected. Based upon the statement of Tschokke, that all laws are powerless for extinguishing an evil which has taken root in the life of the people, it is from the people itself that the reform of morals must proceed, but no government is strong enough to bring it about." [1]

It is as yet too early to judge of the wisdom of this new departure. The teachers themselves must first be taught; and the movement towards

[1] Gustafson, in 'The foundation of death.'

temperance reform will therefore practically begin in the normal schools, to spread thence to all the public schools throughout the various states in which these compulsory laws have been enacted. The receptivity of the young mind is greater than most persons are aware of; and while, at first thought, the instructions of pupils of the age of six years as to the effects of alcohol and tobacco would not seem to promise very great results, still more may be accomplished than would be anticipated. Inasmuch as the end aimed at, if reached, would contribute beyond all calculation to the prosperity and welfare of the human race, the experiment is one which should receive every aid and encouragement possible. It would not be strange if the enforcement of the law demonstrated defects: when these become evident, they can be remedied. If legislators passed no law until it was perfect, the country would be deprived of much useful and needed legislation. D.

NOTES AND NEWS.

COMMISSIONER COLMAN of the agricultural department left for St. Louis on Monday to preside over the conventions of the National sugar association and the Mississippi valley dairymen's association, which are to be held this and next week. At the latter convention the commissioner proposes to show the delegates the progress he is endeavoring to make in the investigations of the adulteration of food, especially of dairy products. Professor Taylor, the microscopist of the department, who claims to have discovered an unfailing test for pure butter as compared with the counterfeit article, will be present, and by means of a magic lantern and a series of micro-photographs will explain the discoveries, and make an address. It is understood that the department is not ready to indorse these discoveries as being absolutely without question; but the commissioner thinks that the convention is entitled to such information as he can furnish, and that the country ought to have the benefit of such suggestions as Professor Taylor has to make.

— A letter from Panama, under date of Jan. 24, states that a government commission, consisting of Professor Rockstrock and Mr. Walker, has been sent from Guatemala to report upon the probability of an outbreak of the Pacaya volcano. The report of these gentlemen announces the total destruction of the village of San Vicente Pacaya. Some forty-four tiled-roof houses completely collapsed, making such a cloud of dust as to create a belief that a new crater had opened. The hot springs surrounding Lake Amatillan emit a larger volume of water, at a higher temperature, than usual. The crater of Pacaya remains unchanged, while that of Fuego has been very lively.

— The invention of Mr. Edison for sending and receiving messages on a moving train was successfully tested, Feb. 1, on the Staten Island railroad. The operator sat in the middle of the centre car of the train, before a desk furnished with a Morse telegraphic key. He held a telephone at each ear. Under the desk was a battery. From this a ground wire was connected with the car-axle and the rail. Another wire passed through the key and to the roof of the car, which was connected with the roofs of the other cars by short pieces of copper wire. Parallel with the railroad were the telegraph wires of the Baltimore and Ohio company. The induction between the metal roof and the telegraph wires was sufficient to allow of the reception by telephone of Morse signals.

— Professor Fuchs, in his twentieth annual report on the seismological events of 1884, gives 123 shocks of earthquakes, distributed in time as follows: winter, 57 (Dec., 19; Jan., 28; Feb., 10); spring, 24 (March, 13; April, 7; May, 4); summer, 21 (June, 5; July, 9; Aug., 7); autumn, 21 (Sept., 8; Oct., 1; Nov., 12). Those deserving individual mention are, March 24, in upper and central Slavonia, where in Diakovar and other places numerous buildings suffered injury; April 22, in England; May 13, in Crevassa, where a church and other buildings were destroyed; May 19, on the Persian Gulf, in which two hundred persons fell victims by the overthrow of their houses; Aug. 10, in the eastern United States; and the Spanish earthquakes in December. In regard to the last, Dr. Fuchs believes the centrum was not a point, but a line parallel to the Sierras Tejeda and Almijara; nor does he think they were of greater importance than those of Belluno in 1873, of Agram in 1880, and of Chios in 1881. There was very little volcanic activity throughout the year, and that only in Aetna, Vesuvius, and St. Augustin, in Alaska.

— Mr. R. L. Harris has lately read a paper on two Daft electric motors, used on the Baltimore street-railways, before the American society of civil engineers: he reports both of these motors as being very successful in all weathers and conditions of the track. The grades are very steep for motors, reaching three hundred and thirty feet per mile in some places; nevertheless these motors have at no time failed to pull overloaded cars with perfect ease. These motors do the work of fifteen horses each, at an average daily running expense of $4.62 for fuel and attendance.

— The recent experiments of the Franklin institute, upon incandescent and arc lights, give the

following averages: one pound of anthracite burned under a good boiler yields, in the incandescent system of lighting, about 40 candles; the same weight of coal gives from the naked arc-light about 158 candles; ordinarily arc-lights are shaded so as to lose about one-half their intensity, so that only 80 candles per pound of coal are available; one pound of bituminous coal will yield from five to six cubic feet of illuminating-gas; this gas will, in the standard argand burner, yield from 14 to 17 candles. Illuminating-gas is burned at once in the simplest manner, and the amount of machinery and care required by electric lighting offsets its greater economy of fuel, light for light. There is little room for improvement in dynamos, but the most important economies will arise from more skilful use and design of the steam-engines required to drive the dynamos. The steam-engine, although much the senior of the dynamo in the list of inventions, is not nearly so well understood. It is but very recently that the laws of condensation and expansion of steam in the engine actually at work have been grasped, and our limitations so clearly defined as to point out the logical way to greater economies, and prevent us from attempting economy under impossible conditions.

— The photograph of the normal solar spectrum, made by Prof. H. A. Rowland at the Johns Hopkins university, Baltimore, is now complete from wave-length 3680 to 5790; and the portion above 3680 to the extremity of the ultra-violet, wave-length about 3100, is nearly ready. Negatives have also been prepared down to and including *B*, and it is possible they may be prepared for publication. The plates, seven in number, all contain two strips of the spectrum, except No. 2, which contains three. They are three feet long and one foot wide. These can now all be furnished to order except No. 2, the negative of which is being made. The plates will be delivered in Baltimore or New York, or will be sent by express or mail, securely packed, at the charge and risk of the purchaser, at the following net prices: the set of seven plates, unmounted, $10; mounted on cloth, $12; single plates, $2 each; mounted on cloth, $2.25.

— A telegram from Guayaquil, of Jan. 20, announces that indications of an earthquake were observed in Chimbo contemporary with a renewed outbreak of the Cotopaxi volcano.

— There are good reasons for supposing that a bill will pass both houses of congress, appropriating fifteen thousand dollars annually to Cornell university for the establishment of an agricultural experiment-station at that institution.

— The Norwegian ship Ferdinand at Philadelphia reports that near midnight of Jan. 8, in latitude 38° 20′ north, longitude 71° 20′ west, during a severe storm of rain and wind, the night being very dark, all the yard-arms and mastheads were suddenly lighted up with St. Elmo's fire, having the appearance of bright lanterns. The phenomenon lasted about three minutes.

— The opening of the third electrical exhibition at St. Petersburg, which took place on Jan. 1, is attracting much attention among the people, especially that portion devoted to the telephone. The exhibition is said to be noteworthy for the novelty, variety, and number of its objects. For illumination, all the known systems of electrical lighting are employed.

— The *Kölnische zeitung* for Jan. 14 states that at the preceding meeting of the Vienna geographical society was announced the discovery, by Dr. Stapf, of a hitherto unknown lake in the Persian desert. The lake, according to Dr. Stapf, is at least forty kilometres long, and is probably of recent origin. According to information obtained from Mohammedan sources, it appears that the lake dried up after a previous existence, and later re-appeared. The water is to a very considerable degree alkaline.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The competition of convict labor.

THE two articles which have appeared in *Science* on this problem (vii. Nos. 153 and 155) by Mr. N. M. Butler treat this subject after the manner of that system or school of political economy which is taught in the colleges, and which rules in business. Its aim and end is profit. It is science 'for revenue only,' and it ignores morality or humanity. It judges all human activity by the standard of profitableness. In reference to this particular question, Mr. Butler formulates that stand-point very characteristically by the following initiatory axiomatic phrase: "That convicts should be employed, if possible, in a manner profitable to the state, is a proposition that no sane man controverts."

To be sure, any thing humane is sentimental nonsense to this school; and any thing so 'unbusinesslike' as the greatest of virtues, charity, is insanity. But this form of 'insanity' is increasing rapidly in the world, and developing a new school of political economy, whose central principle is to further the welfare of all men. From the stand-point of that school, a prison should not be a slave-pen for grinding out 'profit' to the state, but either a refuge for moral cripples or a school for those who lack the moral training necessary to make them good citizens.

About the cause of the agitation of this question among workingmen, Mr. Butler makes some state-

ments which are apt to be misleading. He ascribes it to a few isolated individuals and to sustenance-seeking agitators. The facts are, that whole groups, trades, have directly been affected wherever prison labor has entered the market. The statement which contractors are said to make, that convict labor at fifty cents a day is not cheaper than free labor, is not to be believed except upon the most positive evidence, for the prisoners are driven and tortured to daily perform a set task; and that this is not an average half-day work is pretty safe to surmise.

As to the selfish 'agitator,' he is the great bug-a-boo of those who do not know him, or whose interests are threatened by him. The truth is, that his is a losing business: he is persecuted, blacklisted, hunted, and misunderstood and denounced; and that he still remains true to what he deems his duty is a trait that should be honored by all who can appreciate an unselfish action.

The real stand-point of the humane school and its agitators is, that 'prison labor must go,' in so far as it is directed to the production of wares for the general market. The piece-price plan and similar tub-to-the-whale measures will not stop this agitation. The employment of prisoners towards their own support directly, as food-raising, prison-building, etc., or their employment on public improvements, is the only thing that will divert the rapidly increasing political activity of workingmen as a class from this 'agitation.' E. LANGERFELD.

Your correspondent misses entirely the tenor of the articles referred to. They were not written from the stand-point of any school of political economy whatsoever, but from the stand-point of practical ethics. That convicts are to be subjected to reformatory and ennobling influences is a truism which my articles took for granted. That idleness is an ennobling influence, that productive labor on the part of convicts is of no injury to the community, were the two points which I was concerned to establish. Dogmatic statements in regard to competition of convict with free labor cannot stand in the face of the figures adduced in the second article (*Science*, vii. p. 68), which were in every case official. Having established the fact that convicts are best employed in productive industries, it only remains to determine from the facts, not theories, which of the systems is the best. This is, I claim, the contract system, when it is properly administered. The question of prison labor is a large one, and, in the articles criticised by your correspondent, but a small portion of it was touched upon. NICHOLAS MURRAY BUTLER.

A tornado brood in Hampshire county, Mass.

The facts recently published, showing the wide distribution of tornadoes along the south-eastern border of a stormy area of low barometer, and the further evidence that they occur with special frequency but at no fixed points in certain regions, throw no light on observations made incidentally by me during a residence at Amherst, Mass., from 1870 to nearly 1880. I write this with the hope that persons in the central and western parts of Hampshire county, Mass., will for several years make and record observations of a storm breeding-place to be now described, and note the day and hour, so that the results can be compared with a series of signal-service weather-maps. Some immediate comparison can also be made by noting down at the time the newspaper signal-office report. I have something to say, also, of the peculiar storm or wind-gust that destroyed Northampton bridge in 1877.

My house at Amherst, on 'Mount Pleasant,' commanded the Connecticut River valley for nearly the entire width of Massachusetts. Directly west of me, on a line with the foot of the steepest northern slope of Mount Warner, but west of the river, was what I may term a 'cloud nursery;' not that I remember it as conspicuously originating clouds in a fair sky, but rather and very often as strengthening, enlarging, darkening, any floating cumulus or cumulo-stratus, and seemingly arresting and holding it there until it became sometimes a rain-cloud, and, in three or four instances, a tornado. It seemed to be over or little beyond the hills west of Hatfield. My impression was, that it must be somewhat beyond; namely, over the Mill River valley in the vicinity of Williamsburg. The hills thereabout are not high, not as high as others visible in the Green Mountain range, beyond and to the north. My theory is, that warm, moist, southerly winds all the way from Connecticut, through the wide valley of Southwick, Westfield, Southampton, were thrown upward in the narrowing Mill River valley, which runs north-north-west from Northampton, and so moisture was condensed in the upper air, the upward current at times inviting toward it a tornado inrush of colder air.

Certainly it was just there that two tornadoes by day, and probably one in the evening, originated, Sept. 4, 1873. The apparently stationary cloud had been for some time increasing and darkening, when, soon after noon, I noticed a portion of it hanging down like the inverted crown of a low-crowned hat; and, not long after, the cloud seemed to begin a movement towards the north-east, until, as it approached Whately, the increasing downward projection became ragged at the edges, and two opposite motions of the wisps indicated a whirl. For a moment an ascending funnel from the Connecticut River, near Sunderland, met the descending one from the cloud; and, soon after, the now large and wild whirl struck a shoulder of Mount Toby, levelling a strip of forest, and doing much damage in the village of Long Plain, bounded up the hills east of that, and nothing more was seen or heard of it. The second tornado, an hour later, starting from the same centre, was less threatening in appearance, passed over North Amherst, about seven miles south of the first, and reached the earth only as a harmless gust of wind. A third fell on Northampton at 8 P.M., prostrating many of its grandest elms. There was a fourth, somewhat destructive, at Granby, Mass., just south of the Holyoke range, at 3 P.M, simultaneous with the one that moved over North Amherst. This one at Granby, originating at another point in Hampshire county, and the fact that my pocket-diary notes a storm and violent wind visible in the far north on the following day, suggest some general conditions in the atmosphere favorable to tornadoes, but do not alter the fact that I saw ordinary clouds increase on a day of seemingly ordinary weather, at the spot mentioned, and convert themselves into tornadoes at 1 and 3 o'clock on the day named.

That there may be another local centre south of the Holyoke range, in the region of Granby, is probable from the fact that in 1872, Aug. 16, there was an isolated tornado at Wilbraham and Longmeadow. My note-book, in this connection, only speaks of

heavy rain the 14th and 15th, and on the 16th records 'rain about every P.M. this summer.'

The remarkable gust of rain and wind that wrecked the long bridge over the Connecticut River, and many fine elms there and in Hadley, June 14, 1877, began as the usual darkening of more or less general and ordinary cumulo-stratus at the same centre near Williamsburg. It seemed hardly moving, with a slight sheet of rain, for a while, and then I noticed its rather rapid increase of size and motion. It expanded south-east, in shape like a ploughshare, and its accelerated movement down the hill-slopes toward Northampton became exciting to witness. There was nothing like a downward-reaching funnel; but the whole rain-cloud was near to the earth, and, for a while before reaching the river-bridge, there were, in front of the cloud, wisps of cloud that moved rapidly upward, backward, and downward, as if around a horizontal axis. After passing Hadley, it exhibited no features different from a common rain-cloud, and passed off over the Holyoke range.

Files of signal-service weather-maps may be consulted for the days above mentioned; and citizens of Northampton may recall enough to show whence the tornado came on the evening of Sept. 4, 1873. The hotel on Mount Holyoke would be an excellent post of observation to exactly locate and watch the cloud-intensifying spot above described.

H. W. PARKER.

Grinnell, Io.

Tadpoles in winter.

A few days ago one of my students brought me three large tadpoles, seven centimetres in length, from a well in a depression in an open field. The well overflows in the spring of the year, and the water this winter has been quite cold, yet the tadpoles do not seem torpid at all, but swim freely about.

I had always supposed that these animals could only live in the warmer months of the year, and would like to know if any readers of *Science* have ever found them alive during the winter.

H. M. HILL.

Watertown, N.Y., Jan. 30.

A monument to de Saussure.

The month of August, 1887, is the centenary of the ascent of Mont Blanc by de Saussure, the first to accomplish it after Jacques Balmont, the guide, whose success of the previous year had been stimulated by de Saussure's offer of a prize for the discovery of a practicable route.

The commune of Chamonix, with the co-operation of the French alpine club and others, proposes to erect a monument to the eminent geologist, physicist, and explorer. American contributions toward this object will show our appreciation of the character of the man, and the value of his work.

The Appalachian mountain club, in response to solicitation from the French society, will take pleasure in transmitting donations, which may be sent to the corresponding secretary, Prof. Charles E. Fay, at the club-room. Owing to delay in receiving the invitation, replies must be immediate, as the lists are open abroad only until the close of the present month.

J. RAYNER EDMANDS,
President.

The Appalachian mountain club,
7 Park Street, Boston, Mass., Feb. 2.

The Davenport tablets.

In the issues of your journal for Dec. 25 and Jan. 1, Rev. Cyrus Thomas, of the Bureau of ethnology, directs attention to the Davenport tablets, and seriously questions their authenticity. In entering upon this undertaking, Professor Thomas stated, that, to properly discuss the question of their genuineness, "a personal inspection of the relics, and a thorough investigation of all the circumstances attending their discovery, should be made;" and then he added, "I do not claim to be thus prepared." Probably no writer ever before set out to prepare a piece of 'destructive criticism' with so frank a confession of his disqualification for the task.

In his arraignment of our relics, Professor Thomas charges upon them these grave offences: that on the limestone tablet the sun is represented with a face, and that the artist has carved thereon the 'Arabic 8' and the 'Roman numerals viii;' that on the shale tablets there are also 'three Arabic 8's;' that nearly all of the letter characters of the 'cremation scene' may be found on p. 1766 of Webster's Unabridged dictionary, edition of 1872; and that the two forms of the 'Gallic *O*' appear together on the tablet just as given on the page of the dictionary. These are fair specimens of the arguments by which Professor Thomas attempts to controvert the unimpeached statements of the discoverers. The resemblances indicated are so trivial and purely fanciful as to scarcely attain the level of serious criticism. If Professor Thomas will take the Grave Creek tablet, or even the famous Rosetta stone, and sit down before them with his 'Webster's Unabridged,' he will find no end of similar resemblances. A single glance, for instance, at the Grave Creek tablet will reveal the 'Arabic 4,' twice repeated, and he will find his arguments equally forcible if applied to it. In answer to the accusation that the sun appears with a face, it may be said that this is not uncommon in Indian pictography.

In his impeachment of the limestone tablet, Professor Thomas then advances this argument: "The simple fact that the vault under the pile of loose stones was empty, save the presence of the relic, appears to absolutely forbid the idea of age. It is well known to all who have taken any part in excavating, that the water running down through earth, and a pile of stones beneath, will at length fill all the crevices with earth, and, in fact, all places not hermetically sealed."

It will be noticed that Professor Thomas speaks of this limestone tablet being 'under a pile of loose stones,' which is an inaccurate statement, inasmuch as the vault wherein it was placed was entirely covered by a limestone slab, now in the museum of the academy. Therefore, so far as any direct descent of water was concerned, this vault was practically 'hermetically sealed.' If water entered at all, it must have been horizontally through the wall of loose stones at the sides. The crevices in this wall were filled with decayed shells, and, as most of the water falling upon a mound would pass off on the surface, the small amount of moisture absorbed into its substance would not 'run down through the earth' at all, but instead would slowly percolate from grain to grain of sand or clay, which, having no current like 'running water,' could transport little or no earth. Apparently no good reason can be given why a vault so protected from above, as well as at the sides, could not remain empty for ages.

The literature of archeology, it will be found, furnishes strong support to this conclusion. For want of space, only a single brief reference will be made at this time. Dr. Joseph Jones, in describing a mound opposite the city of Nashville, says, "This stone grave, which was about two feet beneath the surface, had been constructed with such care that little or no earth had fallen in, and the skeleton rested, as it were, in a perfect vault." According to Professor Thomas, the fact that this grave was unfilled with earth would indicate that the 'corpse' was a modern plant, placed there for purposes of deception.

Professor Thomas then cites, as a witness against us, one of our own members, a Mr. A. S. Tiffany. It is therefore proper to state that this venerable gentleman has a grievance against the academy. During the preparations of its first volume of Proceedings, Mr. Tiffany presented for publication a geological paper containing a list of the fossils found in this vicinity, which, after careful examination, was, for good and sufficient reasons, declined. This so offended him that he withdrew from active participation in its proceedings, and ever since has never missed an opportunity to defame his old associates, and denounce its management. It is only necessary to add that he is not an archeologist, was not present at the discovery of the tablet, never examined the mound from which it was taken, and hence his mere opinion can have no scientific value.

Nevertheless, Professor Thomas makes this secret letter of Mr. Tiffany's the corner-stone of his argument. As I have before me a copy of this letter, received through the courtesy of Professor Thomas, I speak advisedly when I state that the quotation used by him is not correctly given. There are in it no less than four alterations of the text. The original indicates illiteracy, whereas the quotation as given by Professor Thomas has all the polish of his own excellent composition. Professor Thomas, moreover, seeks to create the impression, that, inasmuch as Mr. Tiffany was a prominent and active member of our academy, therefore his opinions as stated in this letter should be received as authority; and yet, strange to say, in the very last sentence of this same letter, Mr. Tiffany announced his separation from the academy, and his determination to have nothing more to do with it. Nor is this all. In this identical letter, Mr. Tiffany wrote as follows concerning the shale tablets: "Those shale tablets, I have the utmost confidence that they are genuine. I examined the situation when they were first obtained." Mr. Tiffany never examined the mound from which the limestone tablet was taken, but still he is 'certain' it is a fraud: this Professor Thomas quotes. Mr. Tiffany did examine the mound from which the shale tablets were taken, and pronounces them genuine: this Professor Thomas omits. I am therefore compelled to pronounce the use made of this letter by Professor Thomas as unfair, and his quotations from it as garbled. I would not willingly do him any injustice, and hence now call upon him to publish this letter *verbatim et literatim*. If he will have a facsimile of it prepared by photograph or any other process, and furnished to *Science* for publication, I am prepared to say that such publication would not only destroy its value as authority, but would subject Professor Thomas himself to censure in resorting to such sources for scientific material. To facilitate such publication, I will add, that, if it involves expense not properly belonging to the bureau, I will engage to deposit with the editor of *Science* the necessary amount to meet it. I am of course unable to make any such publication myself, inasmuch as the original letter is in the possession of Professor Thomas, and no copy can do it justice.

Before closing this paper I desire to add a few observations concerning the shale tablets. In order to secure a thorough investigation of their merits, they were sent, soon after their discovery, to the Smithsonian institution, where they remained during a session of the national academy, and were then inspected by its members. In a letter bearing date April 11, 1877, Prof. Spencer F. Baird, secretary of the Smithsonian institution, in acknowledging the receipt of the tablets, said of them, "There seems every indication of genuineness in the specimens, and the discovery is certainly one of very high interest;" and after a more careful inspection of them, and their exhibition to the members of the national academy, the tablets were returned to Davenport; and in his letter bearing date May 31, 1877, Professor Baird thus states his conclusions thereon: "Most of the persons who examined them, among whom were Professor Haldemann, Mr. Lewis H. Morgan, and others, were of the opinion that they were unquestionably of great antiquity, the absolute period of which could not, of course, be measured. The similarity in the weathering of the inscriptions to that of the rest of the tablets gave them this impression." With this favorable indorsement of such men as Prof. Spencer F. Baird, Professor Haldemann, and Lewis H. Morgan, the Davenport academy felt secure in the position it had assumed, and thereupon published its discovery to the scientific world.

In a recent correspondence with Professor Thomas, I learned of his intention to write these papers against the authenticity of the relics in question, and I then submitted to him that it would be manifestly unfair to do so without some previous investigation. I even brought the matter before our academy, and had this resolution adopted, and personally transmitted the same to Professor Thomas at Washington: —

"Whereas the correspondence of Prof. Cyrus Thomas with President Charles E. Putnam has been submitted to the academy, therefore be it resolved, that the academy extends a cordial invitation to Prof. Cyrus Thomas, previous to his proposed publication, to visit its museum, inspect the relics under discussion in the correspondence, examine the mounds where they were discovered, interview the finders, and investigate all available evidence."

This invitation certainly indicated confidence in the genuineness of our relics, and our willingness to have them subjected to the most searching scrutiny. The invitation, however, was, on behalf of the bureau, curtly declined, and on the part of Professor Thomas indefinitely postponed. Apparently our Washington friends are so anxious to condemn, they are afraid to investigate.

CHARLES E. PUTNAM,
President Davenport academy of sciences.
Davenport, Io., Jan. 15.

Topographical models or relief-maps.

In Nos. 153 and 154 of *Science*, reference is made to the use of exaggerated vertical scales in the construction of relief-maps or topographical models; and, as you have been good enough to refer to a piece of work in this line done by myself and wife, — but which is as yet private property in my study, and not

upon the market, as might be inferred from your criticism, — I trust I may be allowed a word relating thereto.

There are various uses for topographical models, and that for which they are designed must necessarily govern their construction. While the technical geologist, in considering orographic questions, finds it undesirable to exaggerate the vertical scale of his cross-sections, such profiles would be absolutely useless in the actual construction of a railroad. It should be equally evident that the needs of school-children under sixteen years, and those of the field geologist, are not necessarily met by identical appliances. The construction of suitable topographical models for use in the common schools is educationally of the utmost importance, and, now that the matter has been referred to, I hope it may receive the consideration it demands. Almost every great physiographic and commercial problem requires the pupil to see his locality and state in its vertical relations to other states and countries; and how best to enable him to do this, is not solved by Professor Lesley's dictum.

What we need to-day for educational purposes, as I see it, is an accurate topographic model of every state in the union, constructed in such proportions as will enable the pupils, in their respective schools, to use it as a working-plan for the making of a larger model of their state. This map should not be isolated. The pupil must see it in its horizontal and vertical relationships to other states. Now, to meet these demands, a relief-map of the United States is required, in which both the horizontal and vertical elements for each state may be measured with sufficient accuracy and facility by the pupil. Such a model must be portable, very strong, and *extremely cheap*. I emphasize the last, because, unless they are cheap, the schools needing them most cannot have them. Now, a model of the United States might be constructed, as Professor Lesley suggests, but it would be useless for topographic purposes if made of any portable size. Our own map has the horizontal scale sixty-five miles to the inch, and it is certainly as large as can be conveniently handled in the average school-room. But taking the Grand Cañon district as an example of what might be done with both scales alike, using Mr. Dutton's profile, extending from the Markagunt plateau southward across the Grand Cañon, for data, we should have the following profile: —

1. Markagunt plateau	10,568	feet	above sea-level,		or	.0295 inch.
2. North bank of Parunuweap	4,659	"	below (1)	"	"	.0138 "
3. Depth of bed of stream...	1,250	"	" (2)	"	"	.0036 "
4. Height of Vermillion Cliffs	1,818	"	above (2)	"	"	.0053 "
5. Foot of Vermillion Cliffs..	1,363	"	be ow (4)	"	"	.0040 "
6. Brink of Permian terrace.	1,022	"	above (5)	"	"	.0030 "
7. Foot of cliff.....	568	"	below (6)	"	"	.0016 "
8. Brink of second terrace....	1,022	"	above (7)	"	"	.0030 "
9. Foot of second terrace.....	1,931	"	below (8)	"	"	.0057 "
10. Brink of Grand Canon....	113	"	above (9)	"	"	.0004 "
11. Bed of Colorado.....	1,363	"	below (10)	"	"	.0040 "

These figures are a sufficient proof of the impracticability of making a model of any large section of country without exaggerating the vertical scale, to say nothing of cheaply reproducing it with any degree of accuracy. Our map, constructed with the horizontal scale 5,000 feet to the inch, that is, the same as the vertical, would be about 16 rods long and 9 rods wide. Were it constructed with the vertical scale the same as the horizontal, Mount Whitney would be but .044 of an inch high; Mount Washington, .018 of an inch; and the highest point in Wisconsin, .0053 of an inch. Our model has attached to it one of the summits of the White Mountains, both scales alike, covering a rectangle 9 by 5 inches, and shows in itself just what the effect of exaggeration is. For my part, when I think of a mountain valley represented on the model, I think of it as 65 times wider than it is in the model; and I believe that pupils, if properly taught, will do so. F. H. KING.

River Falls, Wis.

A national university.

The issue of *Science* for Dec. 11, 1885, contains an article on 'A national university,' with such reference to my connection with the action of the National educational association on this subject, some years ago, as may be thought to demand my attention.

In so far as the article in question deals with the National educational association and its committee on a national university, it is almost wholly devoid of truth, as I proceed to show, with such fulness as a reasonable allotment of space will allow.

1. How does the author of that article know "there is no evidence that the committee ever did any active work"? The assertion is a bold one, untempered by any qualification whatever. And yet the chairman of that committee, having first sought to bring the originator of this and other misrepresentations before the bar of the national association, at Detroit, in 1874, that he might then and there be openly confuted, himself appeared with proof that a large amount of work, in conference, by correspondence, and by the repeated printing and circulation of successive draughts of a bill, had been done by it, all through a period of years.

2. There is equal falsity in the statement that "Dr. Hoyt, although chairman of the committee of the national association, had never been able to get that committee together, and it [the bill] was therefore essentially a bill presented by a private citizen." Probably there never was a meeting of any committee, composed, as this was, of members from each and every state in the union, at which every member was present; but to say, on this account, that a committee, many of whose members had repeatedly conferred with each other on the subject assigned them, never had a meeting, would be a use of terms of which no reasonable person would approve. As a matter of fact, the members of the committee who attended the sessions of the association during the years in question conferred with each other; while all of the members were repeatedly communicated with, and had a voice in the matter under consideration, as truly as though every one had been present at the meetings. Moreover, every report of the committee so agreed upon by conference and correspondence, and presented to the association, was adopted by that great body without one dissenting voice. And, as for the bill at length presented to congress, it was as truly matured by the committee as any bill was ever matured by any committee; for the three successive tentative draughts of it, each embodying some new amendment or amendments, generally concurred in, were severally sent to every member of the committee, for renewed consideration. More than this, copies of the bill, as amended from time to time, were also sent to a large number of other learned gentlemen and statesmen throughout the land, for their criticism and suggestions.

While, therefore, the bill was drawn by the chair-

man (after years of careful study of university education, and a critical inspection of every important university in the world) and received but few modifications, as the result of its successive rounds, it was prepared by authority of the national association, and also embodied the consensus of a still larger number of persons deeply interested in the effort thus made to advance the interests of university education in America. In a word, it was a bill authorized and practically approved by the national association, and no amount of pettifogging can efface the record of the almost unprecedented unanimity with which it was so authorized and approved.

3. Again: nothing could be more astonishingly false than the statement that "neither bill [the one under consideration and another one presented during the same session of congress] was supported by anybody in any way." For the records of the house of representatives will show that the bill matured by the national university committee was not only fully considered by the committee on education and labor of that honorable body, but was at length reported in a strong and able manner with the unanimous recommendation that it pass, as will appear from the concluding passage of the report as published by the house: —

"If, then, it be true, as the committee have briefly endeavored to show, that our country is at present wanting in the facilities for the highest culture in many departments of learning; and if it be true that a central university, besides meeting this demand, would quicken, strengthen, and systematize the schools of the country from the lowest to the highest; that it would increase the amount and the love of pure learning, now too little appreciated by our people, and so improve the intellectual and social status of the nation; that it would tend to homogeneity of sentiment, and thus strengthen the unity and patriotism of the people; that by gathering at its seat distinguished *savants*, not only of our own but other lands, it would eventually make of our national capital the intellectual centre of the world, and so help the United States of America to rank first and highest among the enlightened nations of the earth, — then is it most manifestly the duty of congress to establish and amply endow such a university at the earliest possible day.

"The committee therefore affirm their approval of the bill, and recommend its passage by the house."

4. Last of all, I call attention to the sublime self-complacency with which, in the face of all his superficiality of inquiry and flippancy of statement, the writer under notice deals with the able and learned secretary of the interior and with the merits of the national university question; telling us gravely, as a final settlement of the whole matter, that, "by all the would-be benefactors of American education, many of the difficulties in the way of establishing a national university have been overlooked." And this the dictum of a writer who, in a discussion involving matters of personal justice as well as of public interest, has been content to rely on *ex-parte* testimony, — this his *ex-cathedra* condemnation of a proposition first made by Washington, afterwards supported by a number of his most distinguished successors in the presidential office, and still more recently approved by such statesmen as Sumner, Howe, Schurz, Hoar, Ingalls, and Lamar; by such men of science as Agassiz, Peirce, Shaler, Henry, and Baird; by the heads of nearly all the universities of the United States; and by the largest association of educators in the world.

After this extraordinary manifestation, it does not seem worth while to descant upon our critic's notions concerning the evils of 'free education' and of what he is pleased to call 'the paternal government.' The demonstration of their unsoundness has been so often made, in the past, by educators who are indeed leaders, that it need not be repeated, unless there should at length appear some real 'leader of education' bold enough to express like 'un-American principles.' Up to this time, so far as I know, but one man in the United States, especially entitled by his position to be heard on the subject of a national university, has declared against the measure. Nor is it easy to see why any liberal-minded friend of American education should oppose the general proposition to found and amply endow one great institution for post graduate work, planted in the midst of the many important scientific establishments, as well as libraries, provided by the government, and so planned as to sustain helpful relations to all the universities, colleges, and common schools of the country.

JOHN W. HOYT.

Cheyenne, W. T., Jan. 11.

Temperature of the moon.

My first communication on the temperature of the moon was regarded as supplementary and confirmatory, and not controversial; my second one, as a correction of an erroneous view of my position too hastily formed. Something further here seems necessary with regard to my 'hypothetical moon,' 'an absolutely airless body' with 'equal relative radiating and absorbing powers,' and the 'endless list of limitations.' Unfortunately this is a subject, in whatever way we look at it, in which hypotheses not altogether certain have to be adopted, and in which we have to be satisfied with approximate results, subject to limitations. But my hypothetical moon is very much like the real moon as it has come to me from physicists and astronomers. More than a quarter of a century ago, Stewart established the equality of the radiating and absorbing powers for each kind of heat-ray, and so, of course, for all collectively. But this was from experiments in which there was not much difference between the temperature of the absorbing body and the body from which the heat was radiated; and this law has been extended, without sufficient warrant, to all cases, however great this difference of temperature. Professor Tait, less than two years since ('Heat,' 1884), in giving the usual definition of the equality of radiating and absorbing powers, adds the conditions of a dark body and of equality of temperatures, but immediately after adds, "We assume, with probability, that these latter conditions are not necessary."

In my paper on the 'Temperature of the atmosphere and the earth's surface' (Professional paper of the signal-service, No. 13), I thought it best to make a distinction between the heat received from the sun and that from terrestrial bodies of ordinary temperature. This was suggested by experiments made by De la Provostage and Desains, from which it appeared that polished metals reflected more, and consequently absorbed less, of the heat received from the sun, than from a Locatelli lamp. Accordingly, throughout that paper, a is used to represent the absorbing power of a body for heat from terrestrial

bodies of ordinary temperatures, and a_2 for that from the sun ; and this distinction is made throughout, in all the numerous equations into which the radiated heat of the sun enters.

The necessity for this, which at the time was considered only highly probable, is now fully shown by Mr. Langley's recent very interesting and important experiments on invisible heat spectra (*Amer. journ. sc.*, January, 1886). It requires a glance only at the graphic representation of his results (plate iii.) to see that when the temperatures of the bodies differ, the absorbing power of the body of lower temperature, for the heat of a body of higher temperature, is greater than the radiating power at the end of the spectrum of short wave-lengths, and the reverse at the other end. Hence, where there is selective absorption, as there usually is more or less where any part of the heat is reflected, the radiating and absorbing powers of a body, for the heat-rays as a whole, may not be equal. If the reflected heat were considerable, and mostly of the rays of either end of the spectrum, the difference might be considerable. The amount of heat reflected by the moon is probably much less than that radiated, and the white light of the moon does not indicate that there is much, if any, selective reflection. There cannot, therefore, be much difference between the radiating and absorbing power of the moon for the sun's heat-rays taken collectively. The little difference which there may be would, of course, affect my result slightly. If the absorbing power were a little greater than the radiating power, then the temperature of the moon would have to be a little higher to radiate as much heat as it receives and absorbs. It is seen from what precedes that the possible inequality of radiating and absorbing powers has not been overlooked, and was provided for in my paper referred to above, at a time when there was scarcely a suspicion with regard to the general applicability of the law. But its greatest possible effect on my result was considered of too little consequence to refer to in a short communication on a matter in which, at best, we can expect only approximate results. It is true that the equality of the radiating and absorbing powers was one of my conditions, and that the result is strictly true only for this assumed equality, and that this is therefore one of the 'limitations.' But it does not seem that the 'airless body' should be put into the 'endless list;' for I think that astronomers are very nearly, if not quite, unanimous in the opinion that the moon has no atmosphere which can sensibly affect its radiations.

My conditions, strictly, are for mean or stationary temperatures only; but they are applicable without sensible error to the case of the varying distance of the moon, on account of the slowness with which the distance and the corresponding temperature change. With regard to the lunar diurnal variations, the conditions determine nothing more than the limit beyond which the maximum temperature of any part of the moon's disk cannot go; but this is all that has been claimed. If the method is not of general application, or the results deduced extremely accurate, I think they are not to be despised where we, as yet, know scarcely any thing. The laws of Kepler were important in his time, notwithstanding they did not take into account the 'endless list' of perturbations.

I am sorry Mr. Langley has resolved to have nothing more to say on these interesting subjects, for there are many things, somewhat in common with our separate lines of research, which I would like to discuss in a candid and friendly manner.

WM. FERREL.

Washington, Jan. 28.

Professor Newcomb's address before the American society for psychical research.

In your editorial note of Jan. 29, on Professor Newcomb's presidential address to the American society for psychical research, reference is made to his 'very acute observation' that in certain drawings published by the English society as apparent results of thought-transferrence, "the lines join perfectly, as would be the case with the work of a draughtsman who could see, and this too in the drawings made blindfold." You go on to say that 'the natural inference is that there was some trickery;' and you add, that the English society's work 'bears the character of that of amateurs and enthusiasts.' I think you ought, in justice, to let your readers know that the drawings particularly referred to in the address were five in number. Of the series to which three of these belong, it is conspicuously said, in the accompanying report, that, 'as regards the bandage round his eyes,' the draughtsman 'sometimes pulls it down before he begins to draw.' The two other drawings belong to a series which the report says were executed while the draughtsman 'remained blindfolded.' But, if Professor Newcomb will himself try to reproduce these drawings with his eyes closed, he may perhaps be led to agree that their accuracy can hardly be deemed to fall outside the range attainable by the muscular sense alone, especially if aided by a little practice. To brand as dupes and enthusiasts (on the strength of this single 'acute observation') a set of gentlemen as careful as these English investigators have proved to be, seems to me singularly unjust.

WILLIAM JAMES.

Cambridge, Mass., Jan. 30.

Death of Father Gaetano Chierici.

Prehistoric archeology in Italy has just met with a most serious loss in the sudden death, on the 8th of last month, of Father Gaetano Chierici, professor in the college at Reggio, in Emilia, and director of the admirable Museum of antiquities, in that city. In association with Professor Strobel of Parma, and Professor Pigorini, director of the Ethnographic museum, at Rome, he founded, and has continued to edit, the *Bulletino di paletnologia Italiana*, a monthly journal of prehistoric science, now entering upon its twelfth year. Indefatigable in his prehistoric explorations, he is best known for his investigations of the remarkable *Terremares* of Emilia, which have established the existence of the age of bronze in that country. His last work was to superintend the excavation and transport to Reggio of several tombs from a very ancient cemetery discovered at Renedello, near Brescia. This seems to belong to a period of transition from the age of polished stone to a time when weapons of copper were used, anterior to the age of bronze. Chierici believed that they are remains of the ancient, obscure Pelasgic race.

It is proposed to place a simple bust to the memory of this modest and learned ecclesiastic in the museum which he so admirably arranged and illustrated, and of which he deserves to be called the founder. Con-

tributions for this purpose are asked of Italian paleethnologists, and of such foreign friends as may choose to forward their offerings to Professor Pelligrino Strobel, at Parma. HENRY W. HAYNES.

Boston, Feb. 1.

The moon's atmosphere.

I would be glad if James Freeman Clarke would explain the projection of a planet on the moon's face by the refraction of an atmosphere, as implied in his letter to *Science* of Jan. 8. Would not the rays from the planet pass through the atmosphere in a curve, and reach the eye of the observer in a tangent to that curve at the point where it leaves the atmosphere? If so, then, as this tangent would lie without the moon's disk, the planet could not, by refraction, appear projected upon it. W. G. BLISH.

Niles, Mich., Jan. 21.

After reading the question by Mr. Blish in regard to the phenomenon described by me, viz., of the projection of the disk of Jupiter on the face of the moon at the moment of occultation, I addressed notes to Prof. Edward C. Pickering of Harvard observatory, and Prof. B. A. Gould, asking for their opinions in the matter. Both have kindly answered me, and I transmit a portion of their letters for publication. It will be seen that they agree in the main with Mr. Blish, that refraction by a lunar atmosphere can hardly explain the phenomenon.

JAMES FREEMAN CLARKE.

Jamaica Plain, Mass., Feb. 1.

[From Professor Pickering.]

"A homogeneous and quiet lunar atmosphere would pretty certainly not account for the apparent projection of a star or planet on the disk of the moon, although a disturbance in the atmosphere, either of the moon or of the earth, might momentarily confuse the images viewed through it. I should prefer explaining the phenomenon by the physiological effect of irradiation, which increases the apparent size of bright objects, and so might make two disks seem to overlap each other when they were merely tangent."

[From Professor Gould.]

"The phenomenon which you observed, is, I am inclined to believe, by no means an uncommon one, although, as is natural, the published accounts of it relate chiefly to bright fixed stars, rather than to planets.

"I fear that refraction by a hypothetical atmosphere would not explain the phenomenon adequately, although it seems to me that Mr. Blish has overstated his case, and that the ray emerging from the atmosphere would not necessarily be tangent to the curve at the point of emergence. Turning to Herschel's 'Outlines of astronomy,' — a convenient though not altogether trustworthy book, — I find the same phenomenon mentioned in a footnote to art. 414. He speaks of it as an 'optical illusion,' which perhaps it is; but calling it by that name does not explain it. I myself have seen it, and believe that it has been noted by most observers of occultations, and I have seen attempts to explain it by 'irradiation' and by indentations in the moon's limb; but I have never seen any explanation which has appeared to me satisfactory. It belongs to the same class of phenomena as the 'black ligament,' seen when an inferior planet transits the solar disk. This has never, to my knowledge, been satisfactorily explained either."

Festoon clouds of a tornado.

The clouds so termed by your recent correspondent were more strikingly exhibited than I remember ever to have seen them, on the 17th of June, 1882. They formed the under surface of the high advanced sheet overhanging the memorable tornado that destroyed Iowa college and one-third of the town of Grinnell. Other terms referred to by your correspondent more properly describe the appearance, such as sand-bags, droplets, mammillary cloud, or they might be spoken of as innumerable filled pockets hanging from the under surface of the sheet. It was first seen by me in the western sky at 7 P.M., after a bright sultry day. Near 8 P.M. the whole west was filled with heavy clouds transfused with gold. A fierce thunder-storm followed, and passed by. Immediately after this there was a dead calm for a brief time, and then, at 8.45 P.M., the sudden destructive funnel-cloud. It was a local storm, traced a hundred miles, more or less.

Since then I have watched every threatening sky, and have noticed the same phenomenon, less strikingly shown, in at least a dozen instances, alike in local or limited thunder gusts, widely extended storms, and in rainless skies overspread by wild-looking clouds. A splendid exhibition of the last mentioned was seen at sunset last summer. The whole sky was overcast by gilded cloud showing the 'sand-bag' feature, but in larger bags, either absolutely so, or because drifting at a medium cloud-height and overhead. No evidence of rain, nor any unusual surface winds, preceded, attended, or followed on this occasion. H. W. P.

Grinnell, Io.

Death-rates among college graduates.

The recent death of Charles W. Sanborn of New Hampshire is the occasion for calling attention to a remarkable fact.

His death is the first that has occurred in the Dartmouth college class of 1872. Sixty-nine men graduated, and for thirteen and one half years their number has continued unbroken by death. The Chandler scientific class of the same year early lost one man from eleven who graduated.

The deaths in the two preceding and nine succeeding classes to 1872 are recorded as follows: —

Class.	No. graduated.	Deaths since graduation.
1870	50	11
1871	68	9
1873	71	4
1874	63	5
1875	48	1
1876	69	4
1877	54	2
1878	74	3
1879	46	3
1880	48*	1
1881	49	3

*One died just before commencement, and received degree *post obit.*, but is not included here.

EDWIN J. BARTLETT.

Jan. 28.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 5, 1886.

FISH AND FAMINE IN INDIA.

FAMINE seems to threaten with destruction the people of no part of the world so often as that of India; and the query has often arisen in the mind of the writer why the fish-food of that great empire was not utilized in its prevention to a greater extent. The vast peninsula of Hindostan is surrounded by tropical seas; its shores are low, and indented by lagoons; its interior is penetrated by great rivers; its list of edible fishes is an exceedingly long one. It would seem as though more account ought to be made of this food-supply than appears to be the case.

Fishermen have formed a separate caste in India from earliest times. Originally it was subdivided into those who pursued their calling in the open sea, and those who fished inland waters; but now this distinction is lost in most districts. The remains of a patriarchal organization of the caste — in whose history many figures prominent politically may be recalled — still exist, for the fishermen acknowledge several hereditary chiefs, each of whom exercises priestly control over a wide extent of coast, and is a final referee in all caste or family disputes. Subsidiary to them are lesser chiefs over groups of villages, and elective headmen presiding each over a single hamlet. These chiefs decide disputes, are present at marriages and religious ceremonies, often arrange the work of the village, collect government dues, and receive fines and fees, much of which the lower officers must pass on to their superiors.

The general degeneracy of the sea-fishing interest caused the Indian government recently to set on foot an investigation, which was placed in the hands of Dr. Francis Day, who recounted his results in an intelligent paper read before the late fisheries exhibition in London. It appears from this that the key to comparative prosperity or misery among this class of the population is found in the word 'salt.' The only object of getting sea-fish, which go in schools, and may be captured in large quantities at a time (beyond the trifle able to be consumed fresh on the shore), is to preserve them for subsequent use. This can be done by drying, which is an uncertain way, and results in greater or less putridity, or by the use of salt. Salt has not only been made from sea-water by native methods since ancient times, but in certain regions of the coast, as in western Madras, saline earths are found which form an imperfect substitute.

Former British rulers placed a heavy tax not only on the importation and manufacture of good salt, but even taxed the collection of the poor salt-earth: these impositions varied in different districts, and in some have been removed. Surveying the whole seacoast, it is now seen that wherever salt was dear, except in a few places supported by a brisk local demand (as in the vicinity of large cities), the fish-curer's trade was destroyed, and hence the fishermen were greatly depressed, decreasing in numbers, and seeking to become boatmen or sailors; that fish salted with taxed or monopoly salt was simply a luxury for the rich, and valuable as an export, so that the poor had to consume their fish putrid, or save it for a short time by immersing it in sea-water and drying in the sun; and that which is prepared with the salt-earth keeps badly, and predisposes the consumer to disease. The unmistakable result of this tax has been to discourage and lessen, if not wholly to ruin, a large proportion of the food-producing population of the empire. Moreover, it has brought about not only this special harm, but harm to the general public, whose food-supply is thus not only greatly diminished, but is put at an abnormally high price, since all the fishermen have now sunken into the hands of the money-lenders to whose advances of capital they owe their ability to do any thing at all, and to whom the whole catch must be turned over as soon as taken.

The fresh-water fishes differ in many respects from marine ones. Wherever any quantity of fresh water exists in the east, fishes are certain to be found, all the way from sea-level to near the summit of high mountains. In India this is particularly true, and the people fish in rivers, lakes, irrigation canals, tanks, ditches, swamps, and inundated fields; and, as fishing is a less laborious occupation than agriculture, the pursuit is in high favor in those ease-loving latitudes.

In olden times, under native rule, the fisheries were held as royalties, and mostly were let out to contractors, who retained the sole right to sell fish, but issued licenses, on payment, permitting families to catch for their own use. Remains of this custom, in one form or another, still exist. Along the Himalayas, in the Kangra and other districts, the petty rajahs adopted another plan,

selling licenses to supply the markets, and also to catch with small nets for table use. This was the plan in Burmah also, while the erection of weirs was greatly restricted, or, in some regions, prohibited altogether.

Under British rule these regulations have lost force, and notions once distinct as to fishing privileges and rights have become confused. At first fishermen and fishing implements were both taxed, besides the leasing fees of the fishing-grounds. Gradually these were removed, and many fisheries were made free; but this intended boon has proved an evil, as was the case with the sea-fisheries. Now the inland fisheries are open to all. When whole districts were let to contractors, they were not so short-sighted as to permit indiscriminate destruction; but now everybody does as he likes, when he likes, and how he likes. Every device that can be thought of is called into use. As soon as the monsoon has set in, and the fry begin to move, women and children daily search for them in all the sheltered spots to which they retire for rest or hiding. Nets that would not let a mosquito pass, and even solid cloths, are used for raking out the last one of these fingerlings. So soon as fish commence moving up the rivers for the purpose of breeding, so soon begins the work of destruction, aided by every implement of capture which human ingenuity can invent, not even excepting the scooping-up of whole deposits of fresh ova, and the wholesale poisoning of streams. When the few agile survivors have succeeded in running the gauntlet of weirs, traps, wicker baskets, and nets, of every size and shape, these are all reversed, and set in waiting for their return to the sea. The rod-fishing for mahaseer, the principal game-fish of northern India, is utterly ruined in many districts. Even fishes' eggs do not escape the general hunt to which the persecuted finny-tribes are subjected; for these are collected to be made into cakes, which are thought a great delicacy.

The result of all this heedlessness and indiscriminate destruction is already apparent, and is at last exciting the anxious attention of the rulers of India. The professional fishermen of the empire have decreased in numbers, and their villages are declining into deeper and deeper poverty. In the markets fish-food commands a higher rate than naturally belongs to it, and there is prospect of its steady rise. The longer this goes on, the more fish becomes a luxury for the rich, instead of a common resource for the poor, as seems to be its natural level; and it affords to other nations, as well as India, an example of the poor policy of placing no restrictions upon the harvest of sea and river.

ERNEST INGERSOLL.

THE MOUSE-PLAGUE OF BRAZIL.

IT is well known that the fauna of America, especially that of the higher animals, presents a large number of peculiar types. Not only many of the lesser groups, but sometimes whole families of cosmopolitan orders, such as apes, opossums, etc., we find distinctly separated from those of the old world by some general peculiarity. The indigenous mice of America differ from those of the eastern hemisphere in some features of dentition, and also show a considerable variance in their habits.

The larger number of all the native species belong to a single genus, Hesperomys, of which in Brazil a dozen or more are known, differing in size from that of the ordinary mouse to that of the largest rat. They do not invade dwellings except under unusual circumstances, but mostly live in burrows of greater or less extent; some not less than seven or eight feet in length, widened at the end into a large excavation or chamber, which is filled with grass. They are omnivorous in their habits, feeding indifferently upon grass, seeds, and flesh. Their enemies are numerous, the more important of which are various snakes, and especially the tiger-cat and fox. A large dipterous insect, a bot-fly, is also parasitic upon many, the larvae of which are as large as the end of one's finger, and burrow beneath the skin.

Under ordinary circumstances they are not at all abundant, so that at times naturalists can secure specimens of many species only with difficulty. The almost inconceivable increase and abundance during certain years, to such an extent that they become a national calamity, is thus the more remarkable. In the colony of Lourenço one of these remarkable visitations has thus been described.[1] In the months of May and June, 1876, they suddenly appeared in enormous numbers. They invaded the maize-fields in such great numbers that the corn seemed literally alive with them, destroying in a few days every thing that was edible; and where, but a short time before, bushels of grain might have been harvested, not an ear remained, and the noise produced by their nibbling and climbing was audible for a considerable distance. After the corn-fields were devastated, the potatoes next received their attention. Only the largest were eaten in the ground: such as were transportable were carried away, and hidden in hollow trees or other retreats for future use. Gourds and pumpkins, even the hardest, were gnawed through and eaten. Of green food, such as clover, oats, barley, not a leaf was left standing:

[1] Zur kenntniss der brasilianischen mäuse und mäuseplagen. Dr. H. von Ihring, *Kosmos*, December, 1885.

even weeds were cut down, and the inner parts eaten out.

In the houses the struggle for existence of these long-tailed invaders was truly amazing. In many of the dwellings hundreds were killed in a single day. The cats could contribute but little aid, fighting such a plague; for not only were many of the rats so large that it would have been an unequal contest, but by their great number they drove the cats actually from the houses, not to return until the plague was passed. Nothing, except what was composed of iron, stone, or glass, was spared from their destructiveness: furniture, clothes, hats, boots, books, — every thing bore the traces of their teeth. They gnawed the hoofs of cows and horses in the stables, literally ate up fatted hogs, and often bit away the hair of persons during sleep. They penetrated all apartments, and gnawed their way through boards and walls of houses. Ditches that were dug about granaries did not suffice: the mice would climb over each other in some corner or other, and thus reach the top.

The foregoing account of one occurrence in Lourenço will suffice to show to what an extent the plague reaches. The same province had suffered similarly in 1843 and 1863, and in all probability will again in 1889. Our astonishment at the strange appearance and disappearance of such swarms of animal life is greatly increased when we perceive in what a close relation of cause and effect it stands with the presence or absence of food-supply; and probably nowhere among the vertebrate animals is the relation more apparent than here.

This food-supply is derived from the seeds of a large bamboo-grass (Taquary or Cresciuma) growing throughout Brazil. This grass grows in dense thickets to the height of thirty or forty feet, and bears a very large quantity of seed. Its natural history is remarkable. At regular intervals, varying in the different species from six to thirty years, it matures and blooms, and then disappears. Yet more remarkable is the uniformity with which it attains maturity throughout an entire province, if not the whole southern part of Brazil.

Similar plagues, though far less in extent, have occurred in Europe, in which the field-mice unaccountably appeared in greatly increased numbers. One may well think what would be the result were these little, almost insignificant creatures everywhere in such wise to take the ascendency. When one considers that on an average of every one or two months from five to eight young are born, and that these young become mature in a few months themselves, he will not be surprised to know that a single pair of the common field-mice, in the course of a single summer, would increase to twenty-three thousand individuals. Could all the conditions which now keep them in check be removed, every living thing upon the earth would be consumed in a half-dozen years.

BEE-HIVES AND BEE-HABITS.

ONE of the substantial improvements in bee-hives made in the last few years is the arrangement whereby the frames holding the combs can be quickly and easily turned up side down. The best arrangement of the several tried is where the rectangular frame holding the comb revolves on pivots fastened at the central point of the end-bars, within a half-frame just enough larger to permit the full frame to turn. The half-frame has the projecting top-bar of the usual Langstroth frame, and the half end-bars receive the pivots of the inner frame at their lower ends. Two years' experience shows me that these frames are a success.

But why this inversion of frames and combs in the hives? As is well known, bees only attach their combs firmly at top and upper portions of the lateral edges. It is probable that in past ages our honey-bees attached their combs to limbs of trees, as Apis dorsata does to-day, and as our honey-bees do in exceptional cases: hence the strong instinct to attach firmly above, slightly at the sides, and not at all below. By inverting the frames we take advantage of this habit, and secure firm attachment on all sides, thus making the combs secure for shipping, and less apt to break out when we are extracting or manipulating them for any purpose.

Another invariable habit with bees is to place their brood below the honey in the combs. Thus we always find honey at the top of the comb, and the brood at the bottom. Every bee-keeper is also aware that it is not always easy to induce the bees to leave the brood-chamber below, and pass to the sections above, when we desire to secure the comb-honey. But it is found, that if we invert our frames just as the honey harvest commences, thus throwing the honey below the brood, the bees at once, true to their instinct, pass into the sections, as they wish honey above their brood; and so we not only get the freshly gathered stores, but the honey previously stored in the brood-chamber carried into the sections above, just where we desire it, and all space below vacated for the brood, which is also desirable.

Not only is it desirable to invert the brood-frames, but the sections as well. This secures more firm attachment of the combs in the sec-

tions, and hastens the filling and capping, which is always more quickly and speedily done at the top than at the bottom. It is more than likely that the future hive will be so constructed that the entire hive, as well as the crate holding the sections, can be inverted at pleasure. This will give all the advantages named above with the least possible expense of time. The changing of the comb does no injury in any way, and is thought, by those who have tried it most, to prevent swarming. Turning the combs over causes the bees to tear down the queen-cells.

The late Mr. Samuel Wagoner suggested that the laying of fecundated eggs (those which develop into females) or unfecundated (those which produce drones) was automatic, and not an act of volition. The small worker-cells, he said, would compress the queen's abdomen, and thus force the sperm-cells from the spermatheca, and the eggs would be impregnated. The larger drone-cells would fail to exert this necessary compression, and so the eggs would pass unfecundated.

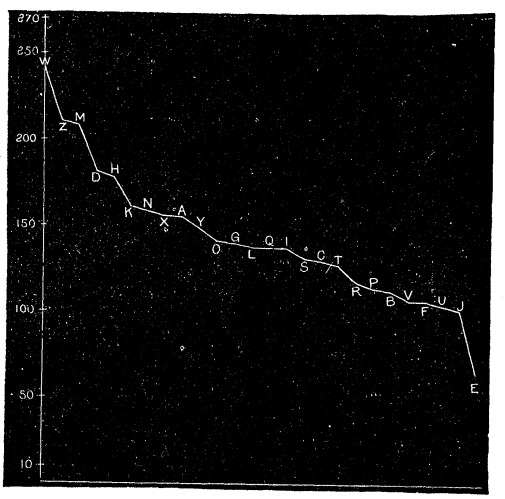
Bee-keepers now generally think that the queen is no such machine. Why the muscular apparatus connected with the spermatheca, except that it is to be used voluntarily to extrude the spermatozoa as the queen may desire? Sometimes worker-cells just started receive eggs which always develop into worker or female bees. Here the cells could not compress the queen's abdomen. The queen also lays fecundated eggs in the queen-cells, which are larger even than the cells which receive the unfecundated eggs, — the so-called drone-cells. That this act of adding or withholding the sperm-cells from the eggs is an act of volition on the part of the queen, is further proved in the fact that young queens, just beginning to lay, often scatter drone-eggs here and there in worker or the small cells. These, of course, produce drones, which only vary from the usual drones in their smaller size, which is necessitated by the smaller cells. This is obviously a mistake, and seldom occurs after the first two or three days of the queen's life. Now, may we not consider this the result of inexperience, the mistake of a novice? The queen has never yet used the complex muscular apparatus of the spermatheca, and at first fails in her attempt to work it satisfactorily. Soon she gains by experience, and makes no more failures. To assert this is no more irrational than to say that a colt will stumble and fall when it first begins to walk.

The observations of Sir John Lubbock and others as to wasps bear directly on this question. He finds that the mother-wasp invariably stocks the cell where the unimpregnated egg — the one that is to produce the male, which is considerably smaller than the female — is deposited with a less number of insects than the one where the impregnated egg which is to develop into a female is placed. Here we see that the mother-wasp not only knows the kind of an egg she is to lay, but she provisions the cells with exact reference to the necessities of the case. As the wasp puts just so many insects in each cell, it is evident that she has learned to count. Who shall be so prejudiced as to say that her waspship does not consider her act in laying the special egg, and does not think and plan her maternal acts looking to the larders of her yet unborn? We all know how close the relationship between wasps and bees is. Now, if a wasp realizes what she is doing as she adds or withholds the sperm-cells, to such an extent that it influences her daily acts, and modifies her performance of daily duties, who shall say that the queen-bee, of higher development and structure, does not think upon her acts as she places the eggs in worker or drone cells? Here, then, is another proof that egg-laying with the queen is a matter of intelligent volition; and far be it from me to say that the queen does not consider the size of her home, the size of her family, and the condition of her larder, as she passes in stately mein over the combs, stocking the worker or drone cells as circumstances dictate. If such volition and discretion are exercised, it makes plain many peculiarities noticed in studying bees. It makes it easy to understand why there is so much variation as to the swarming-habit, drone-production, etc., of different colonies of bees. Each queen has her own notions. A. J. COOK.

LEGIBILITY OF LETTERS OF THE ALPHABET.

MR. JAMES CATTELL has recently published in *Mind* the results of studies upon brain and eye inertia, of which the following will be found of interest. Some alphabets are harder to see than others, and the different letters of the same alphabet are not equally legible. Reading is one of the largest factors in our modern life, but at the same time a thoroughly artificial act. Here, as everywhere in nature, the organism shows its power of accommodating itself to its environment; but the large percentage of children who become shortsighted and weak-eyed, and suffer from headaches, gives us sharp warning, and puts us on our guard, lest these diseases become hereditary. Considering the immense tension put, of necessity, upon eye and brain, it is of the most vital

importance to relieve them by using the printed symbols which can be read with the least effort and strain. Experiments are not necessary to show that books (especially school-books) should be printed in large, clear type; but experiments may lead us to determine the most favorable type. It seems probable that the use of two varieties of letters, capital and small, is more of a hurt than help to the eye and brain. All ornaments on the letters hinder: consequently the German type is injurious. The simplest geometrical forms seem the easiest to see. The lines must not be too thin. We seem to judge the letters from the thick lines, and it is doubtful whether it is advantageous to use thin and thick lines in printing. From all these considerations, it seems that our printing-press has not improved on the alphabet used by the Romans. "Our punctuation-marks are hard to see, and, I think,



quite useless. It seems to me far better to replace (or, at all events, supplement) them by spaces between the words, corresponding in length to the pauses in the thought, or, what is the same thing, to the pauses which should be made in reading the passage aloud. Such a method of indicating to the eye the pauses in the sense would not only make reading easier, but would teach us to think more clearly.

"As I have already stated, not only are some types harder to see than others, but the different letters in the same alphabet are not equally legible." It was found that certain letters were usually correctly read, whereas others were usually misread or not seen at all. Fifty-four series were made with the capital Latin letters: consequently each letter was used 270 times. Out of this number of trials, *W* was seen 241 times, *E* only 63 times. The relative legibility of the different letters is clearly shown in the figure, in which the ordinates are taken proportional to the number of times each letter was read correctly out of the 270 trials.

Certain letters, as *S* and *C*, are hard to recognize in themselves; others are mistaken for letters similar in form, as in the case of *O*, *Q*, *G*, and *C*. The great disadvantage of having in our alphabet letters needlessly difficult to see will be evident to every one. "If I should give the probable time wasted each day through a single letter, as *E*, being needlessly illegible, it would seem almost incredible; and, if we could calculate the necessary strain put upon eye and brain, it would be still more appalling." Now that we know which letters are the most illegible, it is to be hoped that some attempt will be made to modify them. Our entire alphabet and orthography need recasting: we have several altogether useless letters (*C*, *Q*, and *X*), and there are numerous sounds for which no letters exist. In modifying the present letters, or introducing new forms, simplicity and distinctness must be sought after, and experiments such as these will be the best test.

"Experiments made on the small letters show a similar difference in their legibility. Out of a hundred trials, *d* was read correctly 87 times, *s* only 28 times. The order of distinctness for the small letters is as follows; *d*, *k*, *m*, *q*, *h*, *b*, *p*, *w*, *u*, *l*, *j*, *t*, *v*, *z*, *r*, *o*, *f*, *n*, *a*, *x*, *y*, *e*, *i*, *g*, *c*, *s*. As in the case of the capital letters, some letters are hard to see (especially *s*, *g*, *c*, and *x*) owing to their form; others are misread, because there are certain pairs and groups in which the letters are similar. A group of this sort is made up of the slim letters *i*, *j*, *l*, *f*, *t*, which are constantly mistaken the one for the other. It would not perhaps be impossible to put λ in the place of *l*, and the dot should be left away from *i* (as in Greek). It seems absurd, that, in printing, ink and lead should be used to wear out the eye and brain. I have made similar determinations for the capital and small German letters, but these should be given up. Scientific works are now generally printed in the Latin type, and it is to be hoped that it will soon be adopted altogether. At present, however, it is impossible to get the books most read (Goethe, for example) in Latin type."

BLONDES AND BRUNETTES IN GERMANY.

WITHIN the last few years the German government has authorized a commission, at the head of which is Professor Virchow, to collect statistics in

the interests of anthropology on the relative proportions and geographical distribution of blondes and brunettes in the German empire. Before the Anthropological congress at Carlsruhe, Professor Virchow gave an account of the results of these observations, illustrating his remarks by diagrams. An account of the study, together with the illustrations, will appear in full in Germany.

The study included all children of school age throughout Germany. Those only were classed as blondes who had light hair, blue eyes, and a fair complexion. The brunettes included those who had black hair and eyes, though the complexion might be more or less fair. All others were classed as mixed, including those with gray eyes. It is to be regretted that the same method was not followed in Belgium, where similar studies had been in progress, so that a direct comparison could be made.

Thirty-two per cent, or almost a third of the German youth, are blondes; 14 per cent are brunettes; while all the rest, 54 per cent, must be classed as mixed. This mixture is not a homogeneous one, but includes all intermediate varieties. One class of the German population forms a decided exception to these averages, viz., the Jews. Jewish children show only 11 per cent of blondes, but 42 per cent of brunettes. Their greater purity of race is shown by the small ratio of the mixed class amongst them. The blond type is particularly prevalent in Oldenburg and the neighboring more northerly communities: it is rarest in eastern Bavaria and in Alsace. A canton (Wildeshausen) in Oldenburg has 56 per cent of its population blondes, while Roding, a town in the second group, has only 9 per cent, a difference of 47 per cent. The former has only 4 brunettes to each 100 inhabitants, while a southern town in Alsace has as many as 31 to 100. The distribution of the blond type is much wider than that of the brunette type, which is only a secondary type. A canton in Wurtemberg shows the largest ratio of the mixed class, 60 per cent, while Pomerania shows the smallest, 40 per cent. The same contrast between the north and the south is shown in Belgium and in Switzerland. In southern Austria the brunette type is especially marked, but here the mixture with the Slavic people adds a complication.

What is the origin of this dark race amongst the Germans? Ancient writers describe them as having fair hair and eyes. One can assume that the immigrating races were of two types,—blondes and brunettes. But this would not account for the present geographical distribution, or perhaps a gradual transformation has taken place: this is improbable, because the climatic and other differences between north and south Germany are not sufficient to bring about such marked differences. The true explanation is suggested by the large proportion of the mixed class. The Germans were blondes, and spread to the east and south as such; but in Switzerland and Alsace they encountered a dark race, which was not expelled, but forced a mixture with the conquering race. The gray eyes are an indication of this great mixture of types, and not a mark of a third type. The questions regarding the brunette type must be resolved into a series of secondary problems connected with the general development of all the types. It must also be remembered that the characteristics by which the Germans have been described are not peculiar to them, but are common to other anthropologically different nations, of which the Finns are an example. Professor Virchow expressed the opinion that a comparative study of this question in different European nations would be of great importance.

DEFORMITIES OF BONES AMONG THE ANCIENT PERUVIANS.

NEARLY fifty years ago Dr. v. Tschudi, in the disinterment of a number of Indian graves in the vicinity of Lima, found one containing the parts of three skeletons, in which the bones showed peculiar deformities, due to disease. The graves were near the famed temple of Pachacamac; and from the position, as well as the associated objects, Tschudi determined them to belong to one of the earlier epochs of the Incas, in the thirteenth century of the Christian era. From the accounts given by the native Indians, Tschudi learned of other graves, farther south, in which numerous skeletons with similar deformities had been found, and from which he concluded that persons thus afflicted had been buried together, as has been more recently done with the bodies of those dying from cholera.

These specimens were studied a few years later by Zschokke, who found the deformations so different from those produced by other known causes, that he pronounced the disease a new one. Very recently, however, the bones have come under the examination of Professor Virchow,[1] who has determined the cause to have been the affection described under the name of 'multiple exostosis.' This disease is one of the rarest known, and has only been recently studied and described. It is due to abnormal development, and appears most frequently near the ends of the long bones, resulting in remarkable growths, sometimes as

[1] Ueber krankhaft veränderte knochen alter Peruaner, von Rud. Virchow, *Sitzungberichte d. k. preussischen akad. d. wissenschaften*, 1885, p. 1129.

spongy masses, at other times as long, firm, ivory processes of the most varied shapes, several inches or more in length. The disease is more or less hereditary, nevertheless its apparent frequency among the ancient Incas is interesting.

Of more especial interest, however, is the relation which Virchow surmises to exist between this multiple exostosis and the bony growths found with remarkable frequency in the ear-canals of the ancient Peruvian crania. Nearly two scores of specimens have been described, in which either one or both auditory canals were more or less filled with bony growths, usually near the middle. As in nearly all these cases the peculiar flattening or elongation of the occipital region occurs to a greater or less extent, some have assigned this as the cause. Others have thought that the custom, so common among the Incas and other non-civilized races, of wearing rings or large disks of metal in the fleshy ear, had produced the affection. To both of these views Virchow objects. Not only have cases been observed among the North American Indians where there is no cranial deformation, but in the Incas themselves deformed skulls without, and undeformed skulls with, the exostosis, are known. The very common custom among many races of the present day, of wearing foreign substances in the ears, is not known to produce this result. The author believes them to be due to abnormal ossification, of a nature either closely related to, or identical with, that in other parts of the skeleton. Why this disease should have occurred with such greater frequency among this race we do not know, and we can only speculate upon the extent that it affected the audition. The effects of the disease must have been produced in childhood, probably early. In many cases the auditory canal is entirely closed on one or both sides, in others much narrowed. That it must have diminished the power of hearing, is evident. To what extent absolute deafness was caused, one cannot say.

LARGE VERSUS *SMALL TELESCOPES.*

THE critical observer can hardly fail to have noticed, during the past few years, the setting-in of a slight reaction against the monster telescopes and their capacity for advanced astronomical work. Perhaps this is not better defined at present than a tendency to reaction merely; and it seems to have had its origin mainly with a few possessors of medium-sized instruments, who, perhaps, had failed in their efforts to procure larger ones. Any astronomer who has had experience in the adaptation of different kinds of observational work to the varying capacity of different instruments knows very well that there is work enough of a sort which the largest telescopes only are fitted to perform in the best manner; and he also recognizes the fact that in other times of research, which are happily by no means exhausted, the small telescopes have many advantages over the large ones. But these relate rather to the mechanical than to the optical parts of the telescope.

It is not too much to say that the methods peculiar to the opticians of the present day have advanced the construction of the telescope to a degree of perfection which far surpasses the apparent possibilities of observational astronomy in other directions. If the optician gives the astronomer a practically perfect instrument, and the latter finds its performance disappointing, one or other of three things will be true: either he has set it up in a bad atmosphere, or the work to which he has put the instrument is ill adapted to its size, or (it is a good thing for every ambitious fledgling to institute this modest though often disastrous inquiry) the trouble resides in the cerebro-optical apparatus just outside the eye-piece. The first of these conditions appears in a fair way to be partially removed in the early future by the building of mountain observatories in regions where great steadiness of the upper atmosphere is insured; the second gradually removes itself with every new experience; while the third constitutes a very serious obstacle to the progress of the sciences; for what can the conscientious astronomer do with the work of a bad observer? He hesitates to mingle bad observations with good ones, for he cannot tell how much the accuracy of the final result may be impaired; nor does he like to reject the bad ones, because his work is then open to the charge of incompleteness; and, besides, the bad observer makes it an invariable rule to omit all data which might help the theoretical astronomer to find out just how bad his observations are.

Until lately, those who have been discussing in astronomical journals the relative merits of large and of small telescopes have quite overlooked the astonishing variation in the eye-power of different observers. As a general rule, — and for a very obvious reason, — the large telescopes come into the possession of the best observers, while the weaker eyes and heads must continue their use of the smaller instruments. Notwithstanding this natural result of evolution, the lesser telescope sometimes seems to have the greater advantage. While fully realizing the superior power of the great telescope, the observer using it has learned to be very cautious in pronouncing upon what he sees: but the imaginative amateur is bound by no such restrictions; he is free to conceive what

ought to be there, points to his spy-glass, and, lo! there it is. If, then, a trained observer with a larger telescope fails to verify his marvel, what better proof is needed that the great telescope is ineffective? It is an axiom in astronomy, that, when once a discovery is made with a large telescope, the object can always be seen with a smaller one. This presumes, of course, that the same observer uses the two instruments, and that he knows where to look and what to look for with the smaller one. And this in no wise constitutes an argument for equality of the small telescope with the larger; for with a good atmosphere, and the superior telescopes now made, it is never true that the nature of any celestial object can be made out with a small telescope which a larger one will fail to show more satisfactorily. Taken in connection with the attempts of late years, so far successful, to set up powerful telescopes on mountain elevations where a correspondingly perfect atmosphere is obtained, the future of the monster telescope is most hopeful. D. P. T.

MAKING A NEW MERV OASIS.

The Russians have fixed their minds, says *Engineering*, on a new enterprise, well calculated to set on edge the teeth of English and Indian statesmen. This is no other than the formation of a new oasis, as large as that of Merv, along the new frontier to the Oxus, which the Afghan delimitation commission will delineate as soon as the spring weather enables it to quit its winter quarters at Tchamshambe. Briefly, the scheme, which is said to be a sober engineering design, complete in all details, and drawn up on the spot by the surveyors of General Annenkoff, the constructor of the Transcaspian railway, provides for cutting the bank of the Oxus near Tchardjni, and allowing the water to flow afresh through some ancient channels running in the direction of Merv.

There is no particular novelty in the idea, the oasis of Khiva being formed entirely of country irrigated by an elaborate system of canals running out from the Oxus near its entrance into the Aral Sea, while the Merv oasis is of a similar character, and uses up all the water of the Murghab. The channels, we have said, already run into the desert near Tchardjni; and a careful series of levels, taken during the autumn, show, that if the bank of the river be cut, and the channels cleared of drift in one or two places, the water will run freely for sixty or seventy miles. The nomads can then be left to manage the rest of the business themselves; for the natives of Merv and Khiva are extremely clever in making irrigation canals, and they would speedily establish a network, and convert the clayey expanse now devoid of vegetation into a green oasis, as fertile as any in central Asia.

Readers of O'Donovan's and Marvin's books on Merv will not have forgotten, that as far as the Turcomans convey water from the Murghab, there amazing productiveness prevails, although immediately beyond is a desert. All that is really needed, therefore, is to withdraw from the Oxus a sufficient quantity of water (and Annenkoff's calculations show that abundance can be spared), and a year would be sufficient to create an oasis capable of supporting a quarter of a million people. In that case Russia could march troops from Askabad and Merv to the farthest parts of Turkestan, and despatch the Tashkent and Samarcand forces through Bokhara to Merv and Sarakhs in return, without having any desert to traverse, and the communications along the new frontier would be perfect. As the cost would be only £160,000, no doubt whatever is entertained in Russia that Annenkoff's proposal will be accepted.

Dr. Aristides Brezina of Vienna has published a catalogue of the fine collection of meteorites in the Hofkabinet. The richest collections of meteorites are those of the museums of London, Vienna, Paris, and Calcutta. On May 1, 1885, the Vienna collection contained representations of 358 genuine falls. Dr. Brezina accompanies his catalogue by a valuable essay on the origin and classification of meteorites, and by a map of the world showing the localities in which the Vienna specimens have been found.

— The *Revue sud-américaine* of Dec. 30 announces the organization of a new scientific society in Paris under the name, 'Académie de l'Amérique latine.' The academy will be divided into four sections, as follows: social and political; historical and literary; geographical and ethnographical; economical, commercial, and financial. It will be devoted solely to the Latin nations of America, and the membership will be unlimited. It will publish a bulletin in the French, Spanish, and Portuguese languages.

— Extended researches by F. Emich (*Centralblatt für agrik. chemie*) show that the purification of natural waters is effected almost wholly by organic agencies; the chemical action of ozone, peroxide of hydrogen, and the oxidation from the air, exerting but a feeble influence. This was proved by experiments made upon water in which the germs had been destroyed by boiling.